REMARKS

Claims 1, 3-16, 17, and 26 are pending and under consideration. Claim 1 has been amended. Claim 16 has been canceled without prejudice or disclaimer. Support for the amendments to the claims may be found in the claims as originally filed. Reconsideration is requested based on the foregoing amendment and the following remarks.

Response to Arguments:

The Applicants appreciate the consideration given to their arguments, and the new grounds of rejection. The Applicants, however, are disappointed that their arguments were not found to be persuasive.

The final Office Action asserts in section 7, at the bottom of page 7, continuing at the top of page 8, that:

> The Applicant argues that according to MPEP 2143.03, all claim limitations must be taught or suggested. (To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).) The quoted section of MPEP 2143.03 is no longer appropriate and has been deleted from the MPEP in the September 2007 revision.

In re Royko, however, is still good law, regardless of whether it is still quoted specifically in the MPEP.

The final Office Action goes on to assert in section 7, and the first full paragraph at page 8, that:

> According, the Examiner has considered the phrase "maximizing a product of a transmission distance and a transmission capacity of the system" and determined that the phrase is an objective or intended purpose of the filters and fails to differentiate the claimed invention from the prior art.

This is submitted to be incorrect. Determining that a phrase is an objective or intended purpose and fails to differentiate the claimed invention from the prior art does not amount to *considering* all of the words in the claim in judging the *patentability* of the claim *against* the prior art, as required by *In re Wilson*. It simply means that the phrase was disregarded. The Applicants request respectfully, therefore, that all of the words of claim 1, including the recitation "maximizing a product of the transmission distance in a transmission capacity of the system," be considered in judging the patentability of the claim against the prior art.

Claims 17 and 26, moreover, are method claims, which recite "setting a bit rate and frequency spacing of the signal lights so as to approach a spectrum efficiency at which a product

of a transmission distance and a transmission capacity becomes maximum," and "maximizing a product of a transmission distance and a transmission capacity by setting a bit rate and frequency spacing of the signal lights" positively as operations, not functional language. Claims 17 and 26, therefore, ought to be allowable over the cited references.

Nevertheless, in the interest of compact prosecution only, and not for any reason of patentability, claim 1 has been amended further to recite "said filters are configured to yield filtered signal lights having respective bit rates and frequency spacing to approach a spectrum efficiency at which a product of a transmission distance and a transmission capacity of the system is maximized."

Further reconsideration is thus requested.

Claim Rejections - 35 U.S.C. § 103:

Claims 1, 17, and 26 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Bigo et al., "Improving Spectral Efficiency by Ultra-Narrow Optical Filtering to Achieve MultTerabit/s Capacities", OFC 2002, 17-22 March 2002 (hereinafter "Bigo") in view of U.S. Patent No. 6,865,348 to Miyamoto et al. (hereinafter "Miyamoto"), Ramaswami et al., "Optical Networks, A Practical Perspective", by Ramaswami et al., Morgan Kaufmann 1998, pp. 177-180 (hereinafter "Ramaswami-1"), and US Patent No. 6,690,886 to Guy (hereinafter "Guy"). The rejection is traversed to the extent it might apply to the claims as amended. Reconsideration is earnestly solicited.

In the claimed invention, a performance index PI is defined by multiplying a transmission distance proportional to "$10 \cdot (-\Delta Q/10)$" by a transmission capacity proportional to the spectrum efficiency "B/S", as described at paragraph [0082] of the subject application. The last clause of claim 1, in particular, recites:

> Wherein the spectrum efficiency at which the product of said transmission distance and said transmission capacity becomes the maximum value is calculated as spectrum efficiency at which a performance index $PI=10 \cdot (-\Delta Q/10) \cdot B/S$, which is expressed using a Q-value degradation amount ΔQ of the system, a bit rate B and frequency spacing S of the signal light, becomes a maximum value.

Neither Bigo, Miyamoto, Ramaswami-1, nor Guy teaches, discloses, or suggests "the spectrum efficiency at which the product of said transmission distance and said transmission capacity becomes the maximum value is calculated as spectrum efficiency at which a performance index $PI=10 \cdot (-\Delta Q/10) \cdot B/S$, which is expressed using a Q-value degradation

amount ΔQ of the system, a bit rate B and frequency spacing S of the signal light, becomes a maximum value," as recited in claim 1.

Guy, in particular, does not describe maximizing (B/S) and $1/\Delta Q$, contrary to the assertion in section 2 of the final Office Action, in the first full paragraph at page 4. Even if Guy did describe maximizing (B/S) and $1/\Delta Q$, however, that would not amount to the "spectrum efficiency at which a performance index $PI=10 \cdot (-\Delta Q/10) \cdot B/S$, which is expressed using a Q-value degradation amount ΔQ of the system, a bit rate B and frequency spacing S of the signal light, becomes a maximum value" as recited in claim 1, because the recited "$10 \cdot (-\Delta Q/10)$" is not equivalent to $1/\Delta Q$, contrary to the assertion in the final Office Action. Thus, even if Bigo, Miyamoto, Ramaswami-1, and Guy were combined as proposed in the final Office Action, claim 1 would not result.

The second clause of claim 1 recites:

> Said filters are configured to yield filtered signal lights having respective bit rates and frequency spacing to approach a spectrum efficiency at which a product of a transmission distance and a transmission capacity of the system is maximized.

Neither Bigo, Miyamoto, Ramaswami-1, nor Guy teaches, discloses, or suggests "filters are configured to yield filtered signal lights having respective bit rates and frequency spacing to approach a spectrum efficiency at which a product of a transmission distance and a transmission capacity of the system is maximized," as recited in claim 1.

The final Office Action acknowledges graciously in section 2, at the bottom of page 3, that "the combination of Bigo et al., Miyamoto et al. and Ramaswami et al. still fails to teach calculating spectrum efficiency at which a performance index is maximized," and attempts to compensate for this deficiency of Bigo, Miyamoto, and Ramaswami-1 by combining them with Guy. Guy, however, discloses no "filters are configured to yield filtered signal lights having respective bit rates and frequency spacing to approach a spectrum efficiency at which a product of a transmission distance and a transmission capacity of the system is maximized" either, and thus cannot make up for the deficiencies of Bigo, Miyamoto, or Ramaswami-1 with respect to claim 1 in any case.

Guy, rather, describes the high degree of crosstalk between channels due to four wave mixing to be the most significant *limiting* process in ultra dense WDM optical transmission systems. Guy attributes the reason for crosstalk between channels dominating the system performance is the small channel spacing used. In particular, as described at column 3, lines 39-43:

> Therefore, the most significant limiting process in ultra dense WDM optical transmission systems is the high degree of crosstalk between channels due to FWM, and the reason for this effect dominating system performance is the small channel spacing used.

Guy, moreover, describes crosstalk between channels increasing rapidly as the channel spacing is reduced. Consequently, Guy implies that capacity and spectral efficiency are a *tradeoff* of crosstalk and channel spacing, not "a product of a transmission distance and a transmission capacity," as recited in claim 1. In particular, as described at column 3, lines 43-46:

> This effect rapidly increases as one attempts to further reduce the channel spacing (and increase capacity and spectral efficiency).

Guy, moreover, describes four wave mixing as a *limitation* on the maximum reach, capacity, and spectral efficiency that can be achieved, instead of configuring filters "to yield filtered signal lights having respective bit rates and frequency spacing to approach a spectrum efficiency at which a product of a transmission distance and a transmission capacity of the system is maximized," as recited in claim 1. In particular, as described at column 3, lines 46-49:

> The FWM process, then, imposes a limitation on the maximum reach, capacity and spectral efficiency that can be achieved in a very densely packed WDM system.

Guy, moreover, describes the high degree of crosstalk between channels due to four wave mixing as imposing a *limit* on small channel spacing, instead of "a spectrum efficiency at which a product of a transmission distance and a transmission capacity of the system is maximized," as recited in claim 1. In particular, as described at column 6, lines 23-27:

> It was found that the most significant limiting process in such a system (and in any ultra-dense WDM optical transmission system for that matter) is the high degree of crosstalk between channels due to four-wave mixing (FWM), and the reason for this effect dominating system performance is the small channel spacing used.

Guy, finally, describes the crosstalk between channels due to four wave mixing as increasing rapidly as one attempts to increase the capacity and spectral efficiency by further reducing the channel spacing, instead of maximizing "a product of a transmission distance and a transmission capacity of the system," as recited in claim 1. In particular, as described at column 6, lines 27-34:

> As well, it was determined that this effect rapidly increases as one attempts to increase the capacity and spectral efficiency by further reducing the channel spacing. The FWM process, then, imposes a limitation on the maximum reach, capacity and spectral efficiency that can be achieved in a very densely packed WDM system.

Thus, even if Bigo, Miyamoto, and Ramaswami-1 were combined with Guy as proposed in the final Office Action, claim 1 would not result.

The Office action goes on to assert in section 2, in the first full paragraph at page 4, that:

> One of ordinary skill in the art would have been motivated to combine the teaching of Guy with the modified WDM transmission system of Bigo et al., Miyamoto et al. and Ramaswami et al. because reducing channel space increases spectrum efficiency.

Guy, to the contrary, describes the crosstalk between channels due to four wave mixing as increasing rapidly as one attempts to increase the capacity and spectral efficiency by further reducing the channel spacing, as discussed above. It is submitted, therefore, that persons of ordinary skill in the art at the time the invention was made would not have been motivated to modify Bigo, Miyamoto, and Ramaswami-1 as proposed in the final Office Action, because to do so would have increased four wave mixing, and consequently crosstalk, according to Guy.

Claim 1 is submitted to be allowable. Withdrawal of the rejection of claim 1 is earnestly solicited.

Claim 17:

The seventh clause of claim 17 recites:

> Setting a bit rate and frequency spacing of the signal lights are set so as to approach a spectrum efficiency at which a product of a transmission distance and a transmission capacity becomes maximum.

Neither Bigo, Miyamoto, Ramaswami-1, nor Guy teaches, discloses, or suggests "setting a bit rate and frequency spacing of the signal lights are set so as to approach a spectrum efficiency at which a product of a transmission distance and a transmission capacity becomes maximum," as discussed above with respect to the rejection of claim 1.

The last clause of claim 17 recites:

> Wherein the spectrum efficiency at which the product of said transmission distance and said transmission capacity becomes the maximum value is calculated as spectrum efficiency at which a performance index $PI=10 \cdot (-\Delta Q/10) \cdot B/S$, which is expressed using a Q-value degradation amount ΔQ of the system, a bit rate B and frequency spacing S of the signal light, becomes a maximum value.

Neither Bigo, Miyamoto, Ramaswami-1, nor Guy teaches, discloses, or suggests "the spectrum efficiency at which the product of said transmission distance and said transmission capacity becomes the maximum value is calculated as spectrum efficiency at which a performance index $PI=10 \cdot (-\Delta Q/10) \cdot B/S$, which is expressed using a Q-value degradation

amount ΔQ of the system, a bit rate B and frequency spacing S of the signal light, becomes a maximum value," as discussed above with respect to the rejection of claim 1. Thus, even if Bigo, Miyamoto, Ramaswami-1, and Guy were combined as proposed in the final Office Action, claim 17 would not result. Claim 17 is the submitted to be allowable, for at least those reasons discussed above with respect to the rejection of claim 1. Withdrawal of the rejection of claim 17 is earnestly solicited.

Claim 26:

The seventh clause of 26 recites:

> Maximizing a product of a transmission distance and a transmission capacity by setting a bit rate and frequency spacing of the signal lights.

Neither Bigo, Miyamoto, Ramaswami-1 nor Guy teaches, discloses, or suggests "maximizing a product of a transmission distance and a transmission capacity by setting a bit rate and frequency spacing of the signal lights," as discussed above with respect to the rejection of claim.

The last clause of claim 17 recites:

> Wherein the spectrum efficiency at which the product of said transmission distance and said transmission capacity becomes the maximum value is calculated as spectrum efficiency at which a performance index PI=10 · (-ΔQ/10) · B/S, which is expressed using a Q-value degradation amount ΔQ of the system, a bit rate B and frequency spacing S of the signal light, becomes a maximum value.

Neither Bigo, Miyamoto, Ramaswami-1, nor Guy teaches, discloses, or suggests "the spectrum efficiency at which the product of said transmission distance and said transmission capacity becomes the maximum value is calculated as spectrum efficiency at which a performance index PI=10 · (-ΔQ/10) · B/S, which is expressed using a Q-value degradation amount ΔQ of the system, a bit rate B and frequency spacing S of the signal light, becomes a maximum value," as discussed above with respect to the rejection of claim 1. Thus, even if Bigo, Miyamoto, Ramaswami-1, and Guy were combined as proposed in the final Office Action, claim 26 would not result. Claim 26 is thus submitted to be allowable. Withdrawal of the rejection of claim 26 is earnestly solicited.

Claims 3-12:

Claims 3-12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Bigo, Miyamoto, Ramaswami-1, and Guy in view of U.S. Patent No. 6,496,297 to Frankel et al. (hereinafter "Frankel"). The rejection is traversed to the extent it might apply to the claims as amended. Reconsideration is earnestly solicited.

Claims 3-12 depend from claim 1 and add additional distinguishing elements. Neither Bigo, Miyamoto, Ramaswami-1 nor Guy teaches, discloses, or suggests filters "configured to yield filtered signal lights having respective bit rates and frequency spacing to approach a spectrum efficiency at which a product of a transmission distance and a transmission capacity of the system is maximized," or "the spectrum efficiency at which the product of said transmission distance and said transmission capacity becomes the maximum value is calculated as spectrum efficiency at which a performance index $PI=10 \cdot (-\Delta Q/10) \cdot B/S$, which is expressed using a Q-value degradation amount ΔQ of the system, a bit rate B and frequency spacing S of the signal light, becomes a maximum value," as discussed above with respect to the rejection of claim 1. Frankel does not either, and thus cannot make up for the deficiencies of either Bigo, Miyamoto, Ramaswami-1, or Guy with respect to any of claims 3-12. Thus, even if Bigo, Miyamoto, Ramaswami-1, Guy, and Frankel were combined as proposed in the final Office Action, claims 3-12 would not result. Claims 3-12 are thus also submitted to be allowable. Withdrawal of the rejection of claims 3-12 is earnestly solicited.

Claim 13:

Claim 13 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Bigo, Miyamoto, Ramaswami-1, and Guy in view of Ramaswami et al., "Optical Networks", second Edition by Ramaswami et al., Academic Press, 2002, Published 12 October 2001 pp. 139-143 (hereinafter "Ramaswami-2"). The rejection is traversed. Reconsideration is earnestly solicited.

Claim 13 depends from claim 1 and adds additional distinguishing elements. Neither Bigo, Miyamoto, Ramaswami-1, nor Guy teaches, discloses, or suggests filters "configured to yield filtered signal lights having respective bit rates and frequency spacing to approach a spectrum efficiency at which a product of a transmission distance and a transmission capacity of the system is maximized," or "the spectrum efficiency at which the product of said transmission distance and said transmission capacity becomes the maximum value is calculated as spectrum efficiency at which a performance index $PI=10 \cdot (-\Delta Q/10) \cdot B/S$, which is expressed using a Q-value degradation amount ΔQ of the system, a bit rate B and frequency spacing S of the signal light, becomes a maximum value," as discussed above with respect to the rejection of claim 1. Ramaswami-2 does not either, and thus cannot make up for the deficiencies of either Bigo, Miyamoto, Ramaswami-1, or Guy with respect to claim 13. Thus, even if Bigo, Miyamoto, Ramaswami-1, Ramaswami-2, and Guy were combined as proposed in the final Office Action, claim 13 would not result. Claim 13 is thus also submitted to be allowable. Withdrawal of the rejection of claim 13 is earnestly solicited.

Claim 14:

Claim 14 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Bigo, Miyamoto, Ramaswami-1, Guy and Frankel in view of Ramaswami-2. The rejection is traversed to the extent it might apply to the claims as amended. Reconsideration is earnestly solicited.

Claim 14 depends from claim 1 and adds additional distinguishing elements. Neither Bigo, Miyamoto, Ramaswami-1, Guy, Frankel, nor Ramaswami-2 teaches, discloses, or suggests filters "configured to yield filtered signal lights having respective bit rates and frequency spacing to approach a spectrum efficiency at which a product of a transmission distance and a transmission capacity of the system is maximized," or "the spectrum efficiency at which the product of said transmission distance and said transmission capacity becomes the maximum value is calculated as spectrum efficiency at which a performance index $PI=10 \cdot (-\Delta Q/10) \cdot B/S$, which is expressed using a Q-value degradation amount ΔQ of the system, a bit rate B and frequency spacing S of the signal light, becomes a maximum value," as discussed above with respect to the rejection of claim 1 and 13. Thus, even if Bigo, Miyamoto, Ramaswami-1, Guy, Frankel, and Ramaswami-2 were combined as proposed in the final Office Action, claim 14 would not result. Claim 14 is thus also submitted to be allowable. Withdrawal of the rejection of claim 14 is earnestly solicited.

Claim 15:

Claim 15 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Bigo, Miyamoto, Ramaswami-1, Guy and Frankel in view of U.S. Patent Application Publication No. 2002/0025111 to Koshi et al. (hereinafter "Koshi"). The rejection is traversed. Reconsideration is earnestly solicited.

Claim 15 depends from claim 1 and adds additional distinguishing elements. Neither Bigo, Miyamoto, Ramaswami-1, Guy, nor Frankel teaches, discloses, or suggests filters "configured to yield filtered signal lights having respective bit rates and frequency spacing to approach a spectrum efficiency at which a product of a transmission distance and a transmission capacity of the system is maximized," or "the spectrum efficiency at which the product of said transmission distance and said transmission capacity becomes the maximum value is calculated as spectrum efficiency at which a performance index $PI=10 \cdot (-\Delta Q/10) \cdot B/S$, which is expressed using a Q-value degradation amount ΔQ of the system, a bit rate B and frequency spacing S of the signal light, becomes a maximum value," as discussed above with respect to the rejection of claim 1. Koshi does not either, and thus cannot make up for the deficiencies of either Bigo, Miyamoto, Ramaswami-1, or Frankel with respect to claim 15. Thus, even if Bigo, Miyamoto, Ramaswami-1, Guy, Frankel, and Koshi were combined as proposed in the final Office Action,

claim 15 would not result. Claim 15 is thus also submitted to be allowable. Withdrawal of the rejection of claim 15 is earnestly solicited.

Conclusion:

Accordingly, in view of the reasons given above, it is submitted that all of claims 1, 3-16, 17, and 26 are allowable over the cited references. Allowance of all claims 1, 3-16, 17, and 26 and of this entire application is therefore respectfully requested.

If there are any formal matters remaining after this response, the Examiner is invited to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing this Amendment, please charge them to our Deposit Account No. 19-3935.

Respectfully submitted,

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